BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

SCIENCE: DOUBLE AWARD

Paper 3

0569/03

October/November 2017

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your candidate name, Centre number and candidate number in the spaces provided at the top of this page.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do **not** use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.
The number of marks is given in brackets [ ] at the end of each question or part question.
You may lose marks if you do not show your working or if you do not use appropriate units.
You may use a calculator.

A copy of the Periodic Table is printed on page 20.

For Examiner's Use	
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13	
14	
15	
Total	

This document consists of **20** printed pages.

[Turn over

8 Excess copper(II) carbonate is added to 25.0 cm^3 of 1.0 mol / dm^3 hydrochloric acid.

The equation for the reaction is:

$$CuCO_3(s) + 2HCl(aq) \longrightarrow CuCl_2(aq) + CO_2(g) + H_2O(l)$$

(a) Explain why the carbonate should be in excess.

.....

..... [1]

(b) Calculate the number of moles in 25.0 cm^3 of 1.0 mol / dm^3 hydrochloric acid.

moles = ... [2]

(c) Use the equation and the answer in **(b)** to calculate the number of moles of copper(II) carbonate that will react with the acid.

moles = ... [2]

(d) Calculate

(i) the relative molecular mass of copper(II) carbonate,

mass = ... [1]

(ii) the mass of copper(II) carbonate that will react with the acid.

mass = ... [2]

(e) Hydrochloric acid is formed by dissolving hydrogen chloride gas in water.

Use a 'dot and cross' diagram to draw the structure of the ions in hydrochloric acid. Show all the shells in each of the ions.

[3]

(f) Describe a positive chemical test for water.

test .....

result .....

[2]

9 Ethanol and pentanol are members of the same homologous series.

(a) State the name of the homologous series to which ethanol and pentanol belong.

..... [1]

(b) State **two** characteristics of the homologous series to which ethanol and pentanol belong.

1. .....

2. .....

[2]

(c) Draw the structural formula of butanol.

[2]

(d) Ethanol can be produced from the addition reaction of steam with ethene.

(i) Write the equation for the reaction of ethene with steam. Include state symbols.

..... [2]

(ii) State **two** conditions for the reaction in **(d)(i)**.

1. .....

2. .....

[2]

(e) Name another method that can be used to prepare ethanol.

..... [1]

10 Fig. 10.1 shows the electrolysis of aqueous copper(II) sulphate using carbon electrodes.

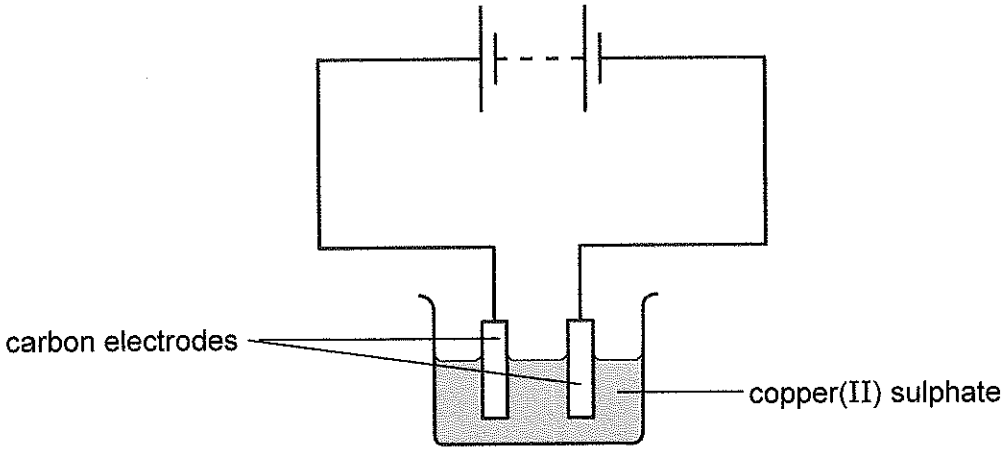

Fig. 10.1

(a) Write the equation for the reaction occurring at the anode.

..... [1]

(b) State **two** observations made during the electrolysis.

1. .....

2. .....

[2]

11 Fig. 11.1(a) shows an animal cell and Fig. 11.1(b) shows a plant cell.

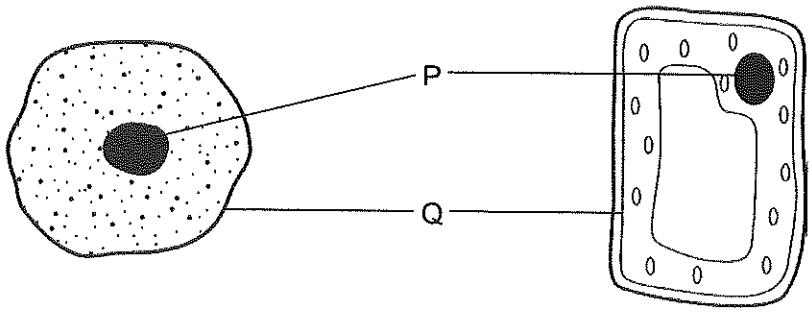

Fig. 11.1(a) **Fig. 11.1(b)**

(a) Name the parts labelled P and Q.

P .....

Q .....

[2]

(b) A red blood cell is an example of a cell in the mammalian circulatory system.

(i) State **one** way in which a red blood cell is different from other animal cells.

..... [1]

(ii) Give an example of one tissue and one organ in the mammalian circulatory system.

tissue .....

organ .....

[2]

12 Fig. 12.1 shows part of the human digestive system.

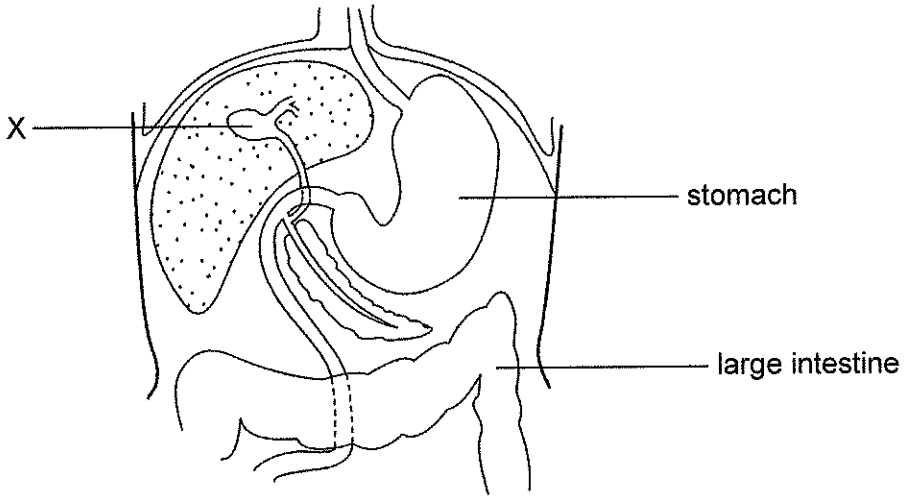

Fig. 12.1

(a) State the function of the part labelled X.

..... [1]

(b) Fig. 12.2 shows a diagrammatic representation of the digestion of starch.

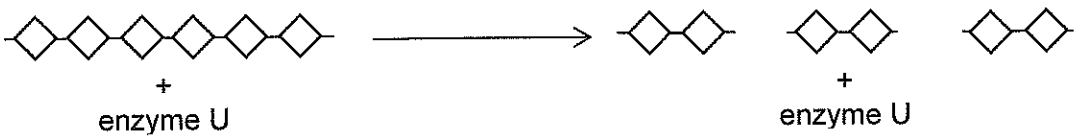

Fig 12.2

(i) State the name of enzyme U.

..... [1]

(ii) What property of enzymes is illustrated in Fig. 12.2?

..... [1]

(iii) On Fig. 12.1, identify a region where the process shown in Fig. 12.2 occurs and label it V. [1]

(c) State **one** function of the stomach.

..... [1]

(d) Pectinase is an enzyme used to extract juice from fruits.
Fig. 12.3 is a graph showing the rate of reaction against temperature for pectinase.

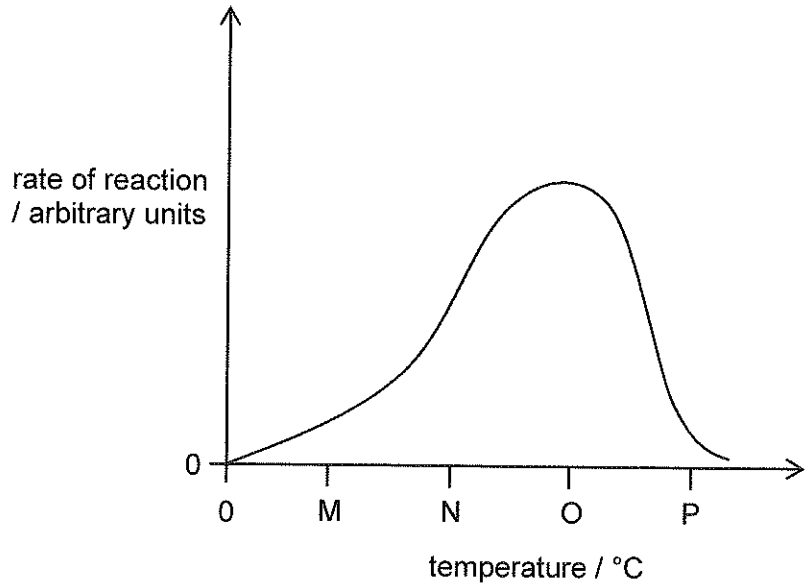

Fig 12.3

Table 12.1 shows the volume of juice extracted at different temperatures from equal amounts of fruit.

Table 12.1

volume of juice extracted / cm^3	temperature / °C
10	
30	
50	
60	

(i) Use the temperatures M, N, O and P, from the graph, to complete Table 12.1. [2]

(ii) Explain why the volume of juice extracted from the fruits was different for the four temperatures M, N, O and P.

.....

.....

.....

..... [3]

13 Fig. 13.1 shows the development of a zygote into a foetus.

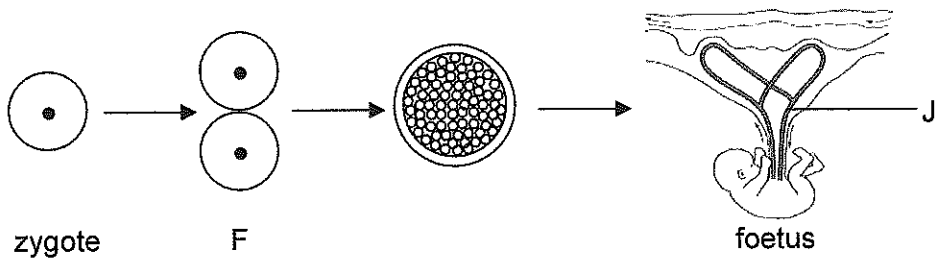

Fig. 13.1

(a) (i) Name the process that results in the formation of a zygote.

..... [1]

(ii) In which part of the female reproductive system is structure F found?

..... [1]

(b) (i) State the name of the structure labelled J.

..... [1]

(ii) A pregnant woman was found to have her foetus not growing well and the foetus moving less than expected.

Suggest how the malfunctioning of structure J may have led to this.

.....

.....

.....

..... [3]

14 Fig. 14.1 shows a food web for a lake.

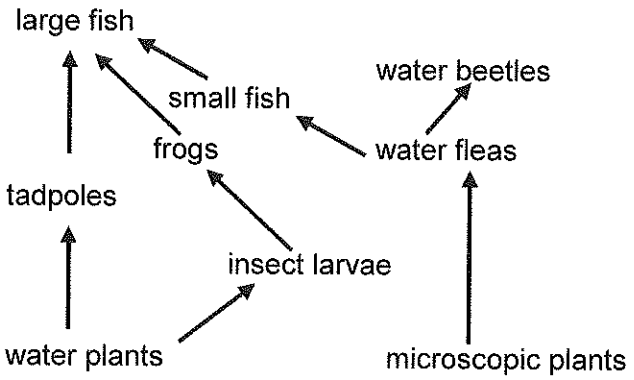

Fig. 14.1

(a) (i) What is the major source of energy for the food web?

..... [1]

(ii) Use the food web in Fig. 14.1 to construct a food chain with four trophic levels.

..... [1]

(b) Fig. 14.2 shows the changes in population size of some organisms in the lake.

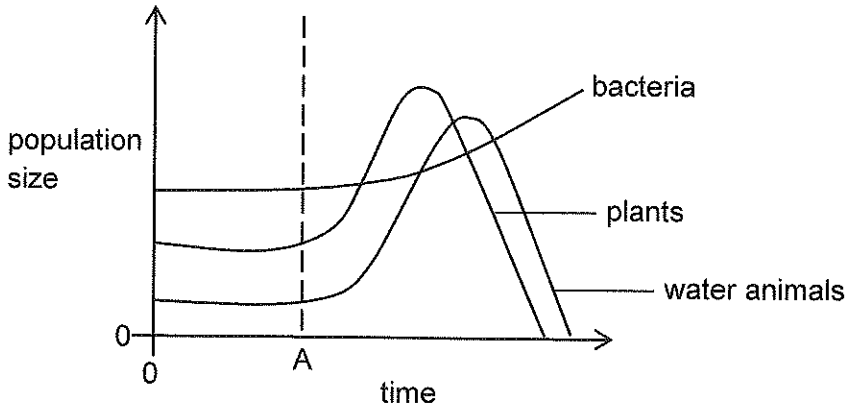

Fig. 14.2

(i) A liquid was spilt into the lake at time A.

Suggest what might have been contained in this liquid to cause the changes in population size.

..... [1]

(ii) Explain the shape of the graphs for the organisms from point A.

.....

.....

.....

..... [4]

15 (a) (i) Define *biotechnology*.

.....

..... [1]

(ii) State the micro-organisms used in the production of

chibuku. .....

madila. .....
[2]

(b) Biotechnology is used in the manufacturing of drugs such as antibiotics.

State **two** differences between antibiotics and non-medicinal drugs.

1. .....

.....

2. .....

.....
[2]

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).